DETAILED ACTION

Claim Objections

1. Claim 5 is objected to because of the following informalities: a claim should be complete into itself. Claim 5 is an independent claim and, as such, formula (I) should be recited rather than referenced to another independent claim. Appropriate correction is required.

Claim Rejections - 35 USC § 101

2. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. Claims 1 - 4 are rejected under 35 U.S.C. 101 because the claimed recitation of a use, without setting forth any steps involved in the process, results in an improper definition of a process, i.e., results in a claim which is not a proper process claim under 35 U.S.C. 101. See for example *Ex parte Dunki*, 153 USPQ 678 (Bd.App. 1967) and *Clinical Products, Ltd.* v. *Brenner*, 255 F. Supp. 131, 149 USPQ 475 (D.D.C. 1966).

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1 – 4 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

6. Claims 1 - 4 provides for the use of dialkyl carbonates as solvent for polystyrene, but, since the claim does not set forth any steps involved in the method/process, it is unclear what method/process applicant is intending to encompass. A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1 – 4 are rejected under 35 U.S.C. 102(b) as being anticipated by Masaya (JP 11005865).

9. Regarding claims 1 and 2: Applicant claims dialkyl carbonates as solvents for expanded polystyrene. Masaya discloses (abstract, [0007], claim 1) the use of carbonates of the formula shown below as solvents for foamed polystyrene,

$$R^1\text{-}(OC_mH_{2m})_x\text{-}O\text{-}CO\text{-}O\text{-}(C_nH_{2n}O)_y\text{-}R^2$$

where X and Y are each an integer of 0 – 2, preferably zero, and R^1 and R^2 are each an alkyl with 1 - 16 carbon atoms, cycloalkyl, etc. These values correspond to applicant's dialkyl carbonate when Masaya's X and Y are zero, and encompass applicant's R_1 and R_2 values of 2 – 15, 1 – 8, and the sum of between 2 – 15 and 5 – 10. Masaya also disclosed ([0015]) the use of two or more of the above solvents, corresponding to applicant's claim of a blend of dialkyl carbonates.

10. Regarding claim 3: Applicant claims dialkyl carbonates selected from those having a flash point higher than 55°C. Masaya discloses (abstract, [008], claims 3 and 4) solvents with flash points of greater than 21°C and preferably more than 70°C , which reads on applicant's higher than 55°C.

11. Regarding claim 4: Applicant claims dialkyl carbonates selected from the group consisting of di-n-butyl carbonate, di-isobutyl carbonate and di-n-propyl carbonate. Similarly, Masaya discloses ([0013]), among others, the same three dialkyl carbonates claimed by applicant.

12. Claims 1, 2, 5 and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Shingo (JP 11080418).

13. Regarding claims 1 and 2: Shingo discloses (abstract, [0007], claims 1 and 2) the use of diethyl carbonate to dissolve foamed polystyrene, corresponding to applicant's use of dialkyl carbonates where applicant's R_1 and R_2 are linear, containing 1 to 12, and 1 to 8, carbon atoms, the sum of carbon atoms being between 2 and 15, and 5 to 10.

14. Regarding claims 5 and 10: applicant claims a process for recycling expanded polystyrene comprising dissolution with dialkyl carbonates, corresponding to Shingo's disclosure (abstract, [007], claims 1 and 2) of a process for recycling foamed polystyrene by dissolving it in diethyl carbonate. Applicant claims removal of the insoluble components. Similarly, Shingo discloses ([0012]) that the polystyrene is dissolved, the impurities removed, and then the polystyrene can be recovered. Applicant claims selective precipitation of polystyrene with non-solvents. Similarly, Shingo discloses (abstract, [0008], [0011], [0012], claims 2 and 5) the use of a lower alcohol as a deposit agent (the word used by the machine translation) to deposit (i.e. precipitate) the polystyrene. Applicant claims the separation, drying and extrusion of the precipitated polystyrene. Shingo discloses ([0016]) stirring until the polystyrene precipitates, then separating and filtering the polystyrene from the mixed liquor for reuse.

Claim Rejections - 35 USC § 103

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

16. Claims 8, 9, 11- 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Peters (US 5,232,954).

17. Peters discloses (abstract, column 2, lines 55 – 60) the process of recovering an expanded thermoplastic resin, such as polystyrene, by dissolving it in a solvent, such as carboxylic esters (column 3, lines 13 – 27), removing impurities (column 4, lines 39 – end) and precipitating the polyester from the mixture by adding alcohol (column 4, lines 25 – 34), corresponding to applicant's claimed process, in claim 5, but failing to disclose the solvent used by applicant.

18. Regarding claims 8 and 9: Peters discloses (column 5, lines 3 – 10) agitating the polystyrene and the solvent at ambient temperature, corresponding to applicant's claim of stirring the system at room temperature. Applicant claims that the stirring continues through the addition of the non-solvent and the styrene is fed onto the bottom of the reactor. Although Peters does not disclose that the stirring continues and that the precipitate are located at the bottom of the reactor, it would have been obvious to one of ordinary skill in the art to continue the stirring of the mixture and to introduce the styrene or the non-solvent into the reactor at a particular section of the reactor.

19. Regarding claims 11 and 12: Applicant claims a ratio between 2:1 and 20:1 and between 3:1 and 15:1 of non-solvent to solvent. Peters does not specify how much of each to use. However, it would have been obvious to one of ordinary skill in the art to have optimized the amount of solvent necessary to dissolve the polymer and the amount of non-solvent necessary to precipitate it.

20. Regarding claims 13, 14, 18: Peters discloses a temperature for the precipitation that is proper to allow for the precipitation of the polyester,

preferably from 20 – 50°C, which fall within applicant's range of 10 – 70°C, taking into account that a different solvent is being used.

21. Regarding claims 15 and 16: Applicant claims a certain flow rate of adding polystyrene into the solvent. Although Peters does not discuss flow rates, it can be optimized for the proper mixing and precipitating and one of ordinary skill in the art would have been able to choose the optimum range.

22. Regarding claim 17: Applicant claims filtering, decanting or centrifugation of the precipitate. Peters discloses (column 5, lines 51 – 51, column 6, lines 29 – 31) various methods of separating the polystyrene, including using paper, cloth or metal filter or a double-vented twin-screw extruder, corresponding to applicant's claim.

23. Regarding claims 19 and 20: Applicant claims drying the polystyrene at temperature ranges of 50 – 180°C and 80 – 150°C and pressures between 760 – 1mm Hg and 500 – 10 mm Hg. Peters discloses (column 5, lines 11 – 16, 20 – 24 and 50 – 51) drying the precipitate by evaporation or vacuum distillation and heated to a temperature of about 110 – 120°C. Peters' temperature falls within applicant's temperature range and his vacuum distillation reads on the pressures claimed by applicant below 760 mm Hg.

24. Claims 1 – 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shingo (JP 11080418) in view of Masaya (JP 11005864) and Peters (US 5,232,954).

25. Masaya discloses dialkyl carbonates as solvents for polystyrene, but fails to teach the process of recovering the polystyrene. Shingo discloses the process of dissolving polystyrene in dialkyl carbonate, removing impurities, adding a non-solvent to precipitate the polyester and separating the polyester for reuse, but fails to teach the exact dialkyl carbonates disclosed by Masaya. Masaya and Shingo do not disclose the specifics of stirring, the selection of temperatures, flow rate and pressures, filtering and drying. Peters discloses these above mentioned conditions and parameters but fails to teach a dialkyl carbonate as the solvent. However, it would have been obvious to one of ordinary skill in the art to have used Masaya's solvent or Shingo's solvent and process of recovering the polystyrene with the same conditions and parameters taught by Peters to arrive at the same results. Moreover, such processes and conditions (to stir the mixture, to select appropriate temperatures, flow rates and pressures, or drying the recycled material) are known in the art and one of ordinary skill in the art would have known the temperatures, pressures, flow rates, amount of stirring or drying to use to arrive at the desired results.

26. Regarding claims 6 and 7: Applicant claims the concentration of polystyrene of 5 – 50% by weight, and 15 – 40% by weight, in the solvent and the dissolution is carried out at atmospheric pressure at a temperature range of 20 – 70^{o}C. Masaya discloses ([0025], examples in [0033] and table 3 in [0034]) a temperature of 70^{o}C or less, corresponding to applicant's range, but fails to discloses the exact concentration of polystyrene to solvent used except for the amounts used in the comparative example of limonene with polystyrene (200mL

and 2g, respectively). Shingo discloses ([0013]) a polystyrene concentration of 15 – 40% by weight, corresponding to applicant's percentage, but fails to teach the temperature used during the dissolution. It would have been obvious to one of ordinary skill in the art to have used Masaya's temperature to dissolve Shingo's polystyrene, since both use similar dialkyl carbonates and the temperatures should be kept to maximize the dissolution of the polymer without boiling off the solvent. It would also have been obvious to one of ordinary skill in the art to have used Shingo's polystyrene concentration to dissolve Masaya's polyester, since it is well known in the art how much solvent should be used to allow for dissolving of a polymer.

27. It would have been obvious to one of ordinary skill in the art to have combined Masaya's solvent for polystyrene or Shingo's solvent and process of dissolving and recovering polystyrene with Peter's steps of stirring the solution, choosing the appropriate temperature, flow rate, pressure and drying the recycled polystyrene to achieve the desired results.

Prior Art Cited But Not Applied

28. Any prior art reference which is cited on Form PTO-892 but not applied is cited to show the general state of the art at the time of applicant's invention. Said references teach various solvents and methods of dissolving, precipitating and recycling polystyrene.

Examiner Information

29. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Frances Tischler whose telephone number is (571)270-5458. The examiner can normally be reached on Monday-Friday 7:30AM - 5:00 PM; off every other Friday.

30. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Larry Tarazano can be reached on 571-272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

31. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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